Faunitaxys

Revue de Faunistique, Taxonomie et Systématique morphologique et moléculaire

Volume 13
Numéro 52

Octobre 2025

ISSN (Print) : 2269 - 6016
ISSN (Online) : 2970 - 4960
Dépôt légal : Octobre 2025

Faunitaxys

Revue de Faunistique, Taxonomie et Systématique morphologique et moléculaire

ZooBank : https://zoobank.org/79A36B2E-F645-4F9A-AE2B-ED32CE6771CC

Directeur de la publication, rédacteur, conception graphique et PAO:
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Faunitaxys est indexé dans / ***Faunitaxys*** is indexed in:
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Imprimée sur les presses de SPEED COPIE, 6, rue Tréfilerie, F- 42100 Saint-Etienne

Imprimé le 01 10 2025

https://doi.org/10.57800/faunitaxys-13(52)

A new subspecies of *Dorcus linwenhsini* Huang & Chen, 2013 from Northern Vietnam (Coleoptera: Lucanidae: Lucaninae)

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Keywords:

Coleoptera;
Lucanidae;
Dorcus;
linwenhsini;
stag beetle;
taxonomy;
description;
new subspecies;
COI;
phylogeny;
Yen Bai;
Lai Chau;
Vietnam.

Abstract. – In this study, a new subspecies of *Dorcus linwenhsini* Huang & Chen, 2013 is described and illustrated, namely *Dorcus linwenhsini conjunctus* Qi, Bian, Xin & Dang **ssp**. **nov**. from Yen Bai and Lai Chau Provinces, Northern Vietnam. The new subspecies can be clearly distinguished from the nominotypical subspecies based on stable character of the inner teeth of the mandibles. Even though some individuals of the new taxon show variations at the apex of the aedeagal flagellum, molecular data analysis reveals that its genetic distance from the nominotypical subspecies is 0.012219–0.013989, supporting its classification as a new subspecies rather than an independent species. A checklist of *Dorcus* taxa from Vietnam is also provided.

Qi Z.-H., Bian C.-Z., Xin F.-Y., Dang V. N., Song H.-T. & Liang G.-H., 2025. – A new subspecies of *Dorcus linwenhsini* Huang & Chen, 2013 from Northern Vietnam (Coleoptera: Lucanidae: Lucaninae). *Faunitaxys*, 13(52): 1 – 10.

DOI: https://doi.org/10.57800/faunitaxys-13(52)

ZooBank: https://zoobank.org/990B0260-EA97-4ACB-BDDE-EF191BA90D4C

Received: 13/07/2025 – *Revised*: 10/08/2025 – *Accepted*: 09/09/2025

Introduction

Vietnam is a country with rich stag beetle (Lucanidae) diversity, and new taxa have been continuously described in recent years (Xin *et al*., 2024a, 2024b; Wang & He, 2024; Yamamoto & Pham, 2025a, 2025b, 2025c; Jo & Tsuboi, 2025). *Dorcus* MacLeay, 1819 is a relatively diverse genus, but there are disagreements among scholars regarding its definition. Here, we follow the definition proposed by Huang & Chen (2013). Prior to this study, approximately 22 taxa conforming to this definition were known in Vietnam.

Huang & Chen (2013) described *Dorcus linwenhsini* Huang & Chen, 2013 from Pianma Town (type locality) and Jinping County, Yunnan Province, China. Its main diagnostic character is that the inner side of the male mandible with two independent large inner teeth, unlike other related species with a connected double tooth. Subsequently, Huang & Chen (2017) reported the new distribution record of this species from Dulongjiang Valley in northwestern Yunnan.

In this study, we describe a representative new subspecies, *Dorcus linwenhsini conjunctus* Qi, Bian, Xin & Dang **ssp**. **nov**., from northern Vietnam based on morphological features and comparisons of mitochondrial COI fragments. Moreover, the latest checklist of the genus *Dorcus* from Vietnam is provided.

Material and methods

Specimens were studied using an Olympus SZ51 stereoscope. To examine the genitalia, the last two abdominal segments were removed, treated with 5% sodium hydroxide solution for the

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appropriate period, and then preserved in glycerol. All habitus photographs were taken using a Nikon D810 DSLR camera, controlled by a WeMacro automatic focus stacking rail, with a Laowa 100 mm f/2.8 CA-Dreamer Macro 2× lens. The light source was completed by the self-made circular supplementary light with the Mioron2835 24V high color LED strip. Photographs of genital and detail features were photographed using a Keyence VHX-5000 digital microscope with a Keyence VH-Z20R zoom lens (20–200×). Helicon Focus 8.2.5 Pro was used for image stacking. Post-processing optimization of the image was done using Adobe Lightroom. Datacolor Spyder Checkr Photo was used for color correction. The images were processed and combined into figures using Adobe Photoshop CC 2020. The authors took all photographs except those with different captions. The morphological terminology follows Huang & Chen (2010, 2013, 2017).

The following codes identify the collections housing the material examined:

CCZB: Personal collection of Cheng-Zhi Bian, Beijing, China;
CXTZ: Personal collection of Xiao-Tian Zhong, Neijiang, Sichuan, China;
CZHQ: Personal collection of Zhi-Hao Qi, Wuyishan, Fujian, China;
NACRC: National Animal Collection Resource Center, Beijing, China;
SHNU: Department of Biology, Shanghai Normal University, China.

Measurement criteria and abbreviations

- **Body length** (TL): length from the apex of mandible to the elytral apex along the midline.
- **Elytral length** (EL): length from the base to the apex of the elytra along the suture.
- **Elytral width** (EW): maximum elytral width.
- **Head length** (HL): length from the tip of the labrum to the anterior margin of the pronotum along the midline.
- **Head width** (HW): maximum head width.
- **Mandible length** (ML): length from the apex of the mandible to its base at the midline of the anterior margin of the head.
- **Pronotal length** (PL): length of pronotum along the midline.
- **Pronotal width** (PW): maximum pronotal width.

The starting genetic material comprised thoracic muscle tissue taken from a cryopreserved specimen maintained in pure ethanol at -20 °C. Following established procedures outlined in the manufacturer's protocol, genomic DNA was purified from this tissue using the Ezup Column Animal Genomic DNA Purification Kit by Sangon Biotech (Shanghai, China).

To target the mitochondrial cytochrome *c* oxidase subunit I (COI) barcode region, polymerase chain reaction (PCR) was employed with the universal primer set LCO1490 and HCO2198 (Folmer *et al*., 1994). Reaction mixtures (25 μL total volume) were prepared containing 12.5 μL of Green Tap Mix by Vazyme (Nanjing, China), forward and reverse primers (1 μL each at 10 μM), 2 μL of extracted DNA, and sufficient molecular-grade water to bring the volume to 25 μL. The thermal cycling profile initiated with a 5-minute denaturation step at 94 °C. This was succeeded by 35 cycles, each consisting of denaturation at 94 °C for 30 seconds, annealing at 53 °C for 30 seconds, and extension at 72 °C for 1 minute. A concluding extension phase was run at 72 °C for 10 minutes. Successful generation of the expected PCR product was assessed by electrophoresis on 1% agarose gels. Purified amplicons were then subjected to bidirectional Sanger sequencing at Sangon Biotech (Shanghai, China).

For comparative phylogenetic purposes, COI sequences of *Dorcus* MacLeay, 1819 species were downloaded from the NCBI GenBank database (http://blast.ncbi.nlm.nih.gov). The specific species analyzed and their corresponding GenBank accession numbers are presented in Fig. 8.

Sequence data were aligned, and genetic divergence was quantified under the Kimura 2-parameter (K2P) model using MEGA 11 software (Tamura *et al*., 2021), incorporating 1000 bootstrap iterations. Phylogenetic inference based on the maximum likelihood optimality criterion was conducted in IQ-TREE (Minh *et al*., 2020). The robustness of inferred tree branches was evaluated with 1000 ultrafast bootstrap replicates. ModelFinder was utilized to identify the best-fitting nucleotide substitution model according to the Bayesian Information Criterion (BIC). The resulting phylogenetic trees were finalized using FigTree v1.4.3 (http://beast.bio.ed.ac.uk/figtree), where annotations were added and graphical elements were optimized to improve the readability of the cladograms.

Results

Genus ***Dorcus*** MacLeay, 1819

Dorcus linwenhsini Huang & Chen, 2013

Dorcus linwenhsini conjunctus Qi, Bian, Xin & Dang **ssp**. **nov**.

(Fig. 1A, B; 2A–D; 3; 4A; 5A–D; 6A, B; 7A–F, J, K)

ZooBank: https://zoobank.org/03387A75-86F8-4468-A802-19C0123E94A3

Holotype, ♂ (NACRC: IOZ (E) 224805; GenBank with accession number of COI: PV876208), Vietnam, Yen Bai Province, Mu Cang Chai District, La Pan Tan Village, 2100 m, VI.2024, Van Ngoc Dang leg.

Paratypes

- **2** ♂ (CCZB, CZHQ), same data as holotype;
- **1** ♂ (CCZB; GenBank with accession number of COI: PV876207) Vietnam, Lai Chau Province, 1800 m, VIII.2023, Van Ngoc Dang leg.;
- **4** ♂ (CCZB), same data as holotype but V.2025;
- **1** ♂ (CXTZ), same data as holotype but V.2025, local collector leg.

Diagnosis. – The males (except for small sized) of this new subspecies can be clearly distinguished from the nominotypical subspecies based on the following morphological characters:

1- Each mandible with two large connected inner teeth (Fig. 1A; 2A, C), instead of with two large independent teeth (Fig. 1C; 2E);

2- Surface of elytra more or less covered with fine frosted texture and has a certain degree of gloss (Fig. 4A), rather than almost smooth and has a strong gloss (Fig. 4B).

Additionally, two individuals of the new subspecies (n=4), the villi at the distal end of the aedeagal flagellum inconspicuous and finer than those of the nominotypical subspecies (Fig. 7K).

Description

Measurements. – TL: 33.5 mm; HL: 5.3 mm; HW: 9.4 mm; ML: 8.9 mm; PL: 5.7 mm; PW: 10.6 mm; EL: 14.2 mm; EW: 10.1 mm.

Habitus (Fig. 1A, B). – Body black with glossy, generally glabrous; some distinct, recumbent, yellowish pubescence present on the lateral parts of the metasternum.

Head. – Transverse, about 1.8 times wider than long, widest at eyes. Canthus thin, dividing more than 1/2 of the eye. Clypeolabrum strongly transverse, widely and distinctly emarginate at the apical margin; lateral angles of clypeolabrum prominent, with the tips weakly acute. Mandible about 1.7 times as long as the head, relatively incurved at apical third; the tip of the mandible sharp, with a small, rounded protuberance on the dorsolateral surface behind the apex; two connected large inner teeth before the middle, the lower inner tooth larger and more prominent, with a rounded apex pointing inward; the upper one relatively less prominent, with a rounded apex pointing anterolaterally. Postocular margin bulged into a slight process. Mentum transverse, about 3.7 times wider than long, anterior margin not emarginated, lateral angles absent, the surface evenly and sparsely distributed with large punctures. Antennal club with three antennomeres; antennomere 7 slightly extended inwards; antennomeres 8-10 lamellate.

Pronotum. – Transverse, about 1.9 times wider than long, widest at apical quarter. Anterior margin bisinuate, anterior angles weakly acute; lateral angles weakly acute; posterior margin almost straight, posterior angles obtuse.

Scutellum. – Subtriangular, minute punctate, 1.3 times wider than long.

Legs. – Protibia with 5-7 continuous teeth (excluding apical fork) along outer margin, apex bifurcate with sharp branches at tip. Except apical spurs

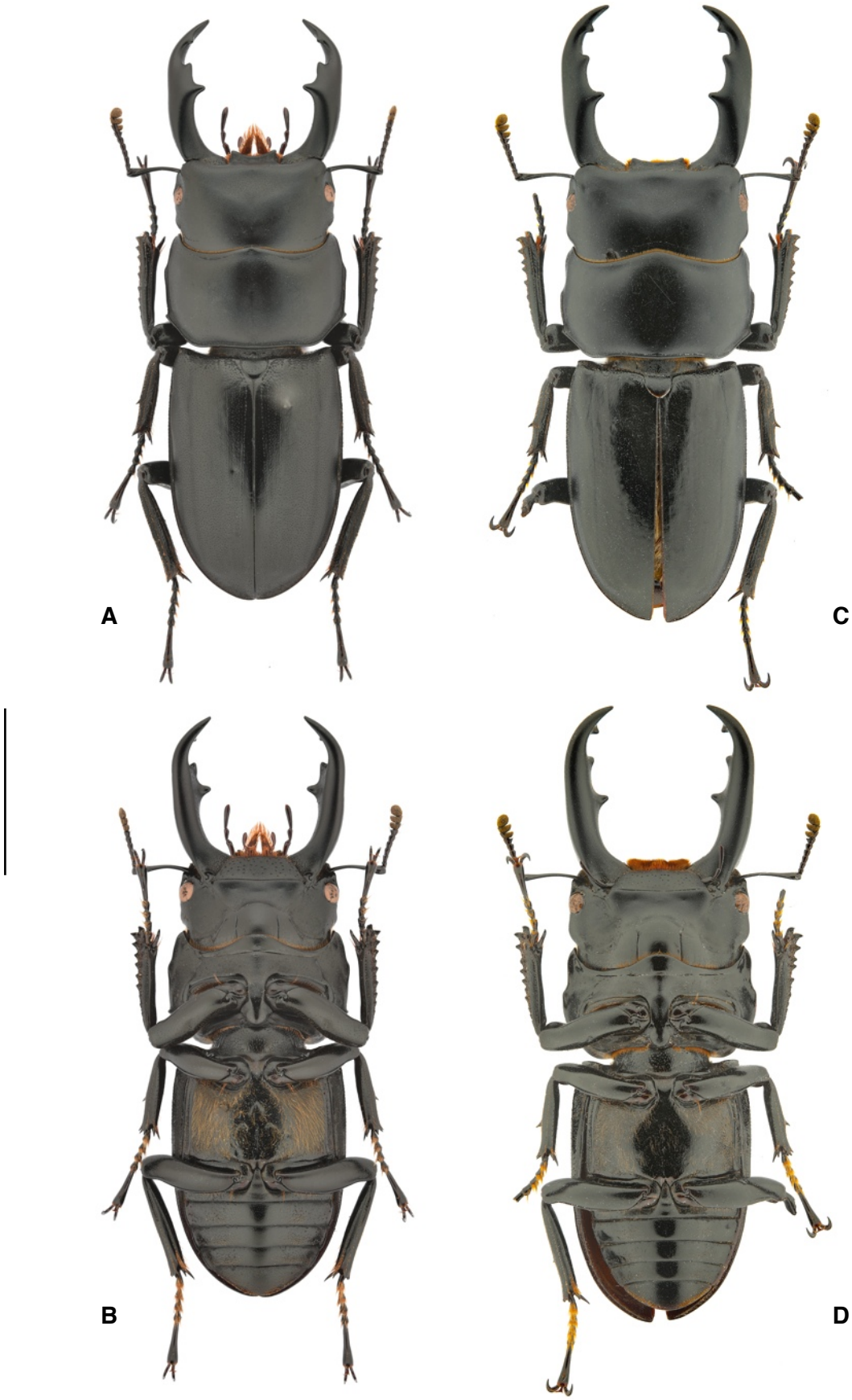

Fig. **1**. Habitus of medium sized males of *Dorcus linwenhsini* ssp. (Scale bar = 10.0 mm).

A, **B**. *D. l. conjunctus* Qi, Bian, Xin & Dang **ssp**. **nov**., holotype, 33.5 mm, Yen Bai, Vietnam. **C**, **D**. *D. l. linwenhsini* Huang & Chen, 2013, 35.6 mm, Kachin, Myanmar. **A**, **C**. Dorsal view. **B**, **D**. Ventral view.

and spines, each mesotibia with one lateral spine, and metatibia without lateral spine.

Elytra. – Elongate, 1.4 times longer than wide, the anterior margin of elytra slightly narrower than pronotum; anterior margin with dense large punctures, and the area beyond that evenly and finely punctate.

Abdomen and aedeagus. – Ventral plate of abdominal segment 9 (Fig. 5B) narrowest near the base, without membranous area. Aedeagus (Fig. 7A) about 3.2 times longer than wide in ventral view. Basal piece distinctly constricted in basal part, about 1.7 times as long as parameres, with a pair of well-developed sclerotized dorsal plates (Fig. 7C). The basal process of paramere almost absent, paramere upturned and apically obtuse in lateral view (Fig. 7B). Penis distinctly shorter than paramere, widest just behind the apex. Flagellum (Fig. 6A) long and unbranched, about 1.8 times as long as aedeagus, the apex shown in Fig. 7J.

Variation. – Body length of male paratypes 26.3–51.0 mm (n=8). In large individuals (Fig. 2A–D), the upper inner tooth of mandible more developed, the protuberance behind the apex more distinct, and the outer margin of metatibia with a small lateral spine. In the small individual (Fig. 3A, B), dorsal surface with relatively dense and distinct punctures. Head about 1.3 times as long as the mandible, only with a subtriangular single inner tooth before the half length of mandible, the protuberance behind the apex absent. Elytra with dense rows of punctures, sides of elytral suture obviously broad.

Etymology. – The specific name "conjunctus" refers to the two connected inner teeth of the mandible.

Type locality. – Vietnam, Yen Bai Province, Mu Cang Chai District, La Pa Tan Village.

Distribution. – Vietnam (Yen Bai, Lai Chau).

Molecular analysis. – The "TIM2+F+G4" models, exhibiting the lowest BIC scores, were selected as best describing the nucleotide substitution pattern. Within the resulting phylogeny, the new subspecies forms a distinct, strongly supported clade separate from the nominotypical subspecies, despite a relatively small genetic distance (0.012219–0.013989). When combined with its distinct and stable morphological characters, this evidence robustly supports the recognition of the new subspecies as valid (Fig. 8).

Material examined for comparison

Dorcus linwenhsini linwenhsini Huang & Chen, 2013

Dorcus linwenhsini Huang & Chen, 2013: 450. (holotype in SHNU); Yi 2023: 62 (as *Serrognathus*).

Material examined

- **1** ♂ (CXTZ), China, Yunnan Province, Nujiang Lisu Autonomous Prefecture, Lushui County, Pianma Township, alt. 2200–2700 m, V.2022, local collector leg.;

- **1** ♂ (CCZB; GenBank with accession number of COI: PV876209) Myanmar, Kachin State, Nanse Village alt. 2000-2500 m, VII.2020, local collector leg.

Type locality. – China, Yunnan Province, Nujiang Lisu Autonomous Prefecture, Lushui County, Pianma Township.

Distribution. – China (Yunnan), Myanmar (Kachin).

Discussion. – The males of new subspecies exhibits stable and pronounced external morphological distinctions from the nominotypical subspecies. However, COI-based analyses revealed minimal genetic divergence (0.012219–0.013989), which typically falls within the range of intraspecific variation in some stag beetle taxa (Qi *et al*., 2024; Xin *et al*., 2025). Due to the incomplete molecular data on the genus *Dorcus*, a systematic analysis cannot be conducted at present. Based on a comprehensive consideration of the aforementioned differences, we believe that treating the newly described taxon as a subspecies of *Dorcus linwenhsini* is more appropriate.

Checklist of *Dorcus* MacLeay, 1819 from Vietnam

According to the definition of the genus *Dorcus* by Huang & Chen (2013), there are currently 23 clearly recorded species/subspecies of this genus in Vietnam, including the following taxa (Fujita, 2010; Huang & Chen, 2013, 2017; Tsuchiya, 2018; Yi, 2023; Jo & Tsuboi, 2025; the present study):

– *Dorcus antaeus datei* Fujita, 2010
– *Dorcus antaeus miyashitai* Fujita, 2010
– *Dorcus arrowi lieni* Maeda, 2012
– *Dorcus arrowi magdeleinae* (Lacroix, 1972)
– *Dorcus branaungi* Nagai, 2000
– *Dorcus cervulus* (Boileau, 1901)
– *Dorcus curvidens babai* Fujita, 2010
– *Dorcus curvidens curvidens* (Hope, 1840)
– *Dorcus daedalion* (Didier & Seguy, 1953)
– *Dorcus fujiii* Nagai, 2010
– *Dorcus grandis grandis* Didier, 1926
– *Dorcus hirticornis* ssp.
– *Dorcus kamijoi* Fujita, 2009
– *Dorcus katsurai* Ikeda, 2000
– *Dorcus laevidorsis* Fairmaire, 1888
– *Dorcus linwenhsini conjunctus* Qi, Bian, Xin & Dang **ssp**. **nov**.
– *Dorcus sinensis kentai* Tsukawaki, 1999
– *Dorcus tanakai* Nagai, 2002
– *Dorcus tatsuhikoi* Fujii & Okuda, 2020
– *Dorcus tsunodai* Fujita, 2009
– *Dorcus velutinus* Thomson, 1862
– *Dorcus vietnamicus* (Jo & Tsuboi, 2025)
– *Dorcus yaksha yaksha* Gravely, 1915

Huang & Chen (2013) examined three specimens (1 male and 2 females) of *Dorcus linwenhsini* (nominotypical subspecies) from Fenshuiling Nature Reserve, Jinping County, Yunnan Province, China among which the only male was a small individual. After examining their genitalia, the authors collectively designated them as paratypes of the nominotypical subspecies. Currently, it seems that the individuals from Jinping are most likely *D. linwenhsini conjunctus* Qi, Bian, Xin & Dang **ssp**. **nov**. rather than ssp. *linwenhsini*. Because Jinping is over 530 kilometers in straight-line distance from the type locality (Pianma, Yunnan) of ssp. *linwenhsini*, with a certain degree of geographical isolation, while being adjacent to Lai Chau, Vietnam. We suspect that the authors' viewpoint on the specimens from Jinping was probably due to the indistinct mandibular characters of the small sized male and the similar genitalia between the two subspecies.

Acknowledgements

We are grateful to Mr. Xiao-Tian Zhong (Sichuan, China) for lending us the large sized specimen of *Dorcus linwenhsini linwenhsini* for comparison and providing a paratype of the new subspecies; to Mr. Yi-Feng Zhang (Fujian Academy of Forestry, China) for his guidance in taking specimen photos and preparing figures; to Mrs. Phuong Bich Thi Ho and Mrs. Tien Thuy Nguyen Dang (both Lam Dong, Vietnam) for their support and help to the second and fourth authors during the research process; to Mr. Kazuho Kobayashi (Sendai Collage of Eco and animals, Japan) for helping take photos of some specimens preserved in Japan, although they were not used in this study. We also extend our hearty thanks to Mr. Hao Huang (Shandong, China) and Mr. Chang-Chin Chen (Tianjin, China) for providing essential references; to Mr. Xu-Hong-Yi Zheng (Nanjing Normal University, China) and another anonymous reviewer for their valuable comments on the manuscript.

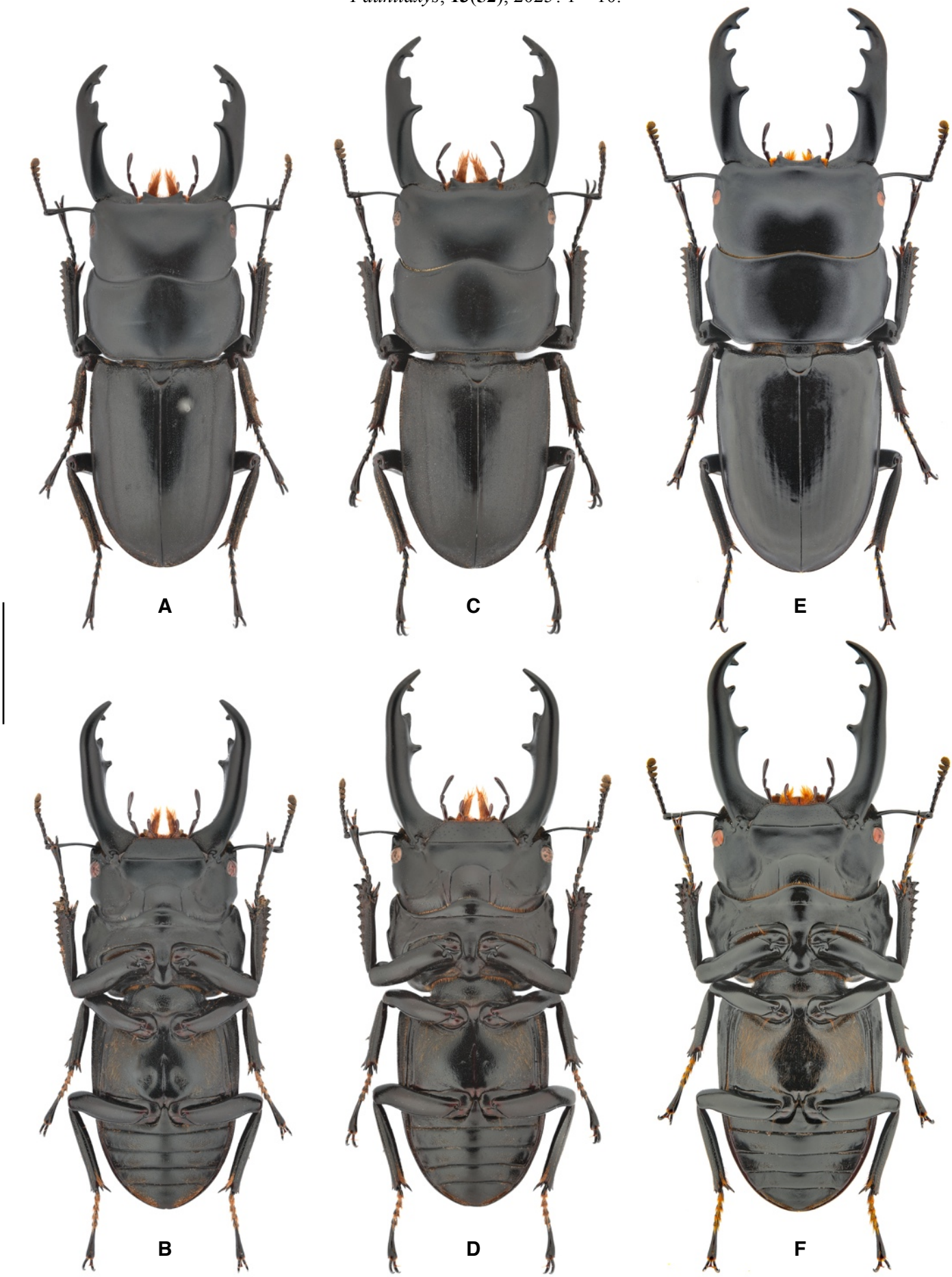

Fig. **2**. Habitus of large sized males of *Dorcus linwenhsini* ssp. (Scale bar = 10.0 mm).

A, **B**. *D. l. conjunctus* Qi, Bian, Xin & Dang **ssp**. **nov**., paratype, 40.6 mm, Yen Bai, Vietnam. **C**, **D**. *D. l. conjunctus* Qi, Bian, Xin & Dang **ssp**. **nov**., paratype, 42.7 mm, Lai Chau, Vietnam. **E**, **F**. *D. l. linwenhsini* Huang & Chen, 2013, 45.5 mm, Yunnan, China. **A**, **C**, **E**. Dorsal view. **B**, **D**, **F**. Ventral view.

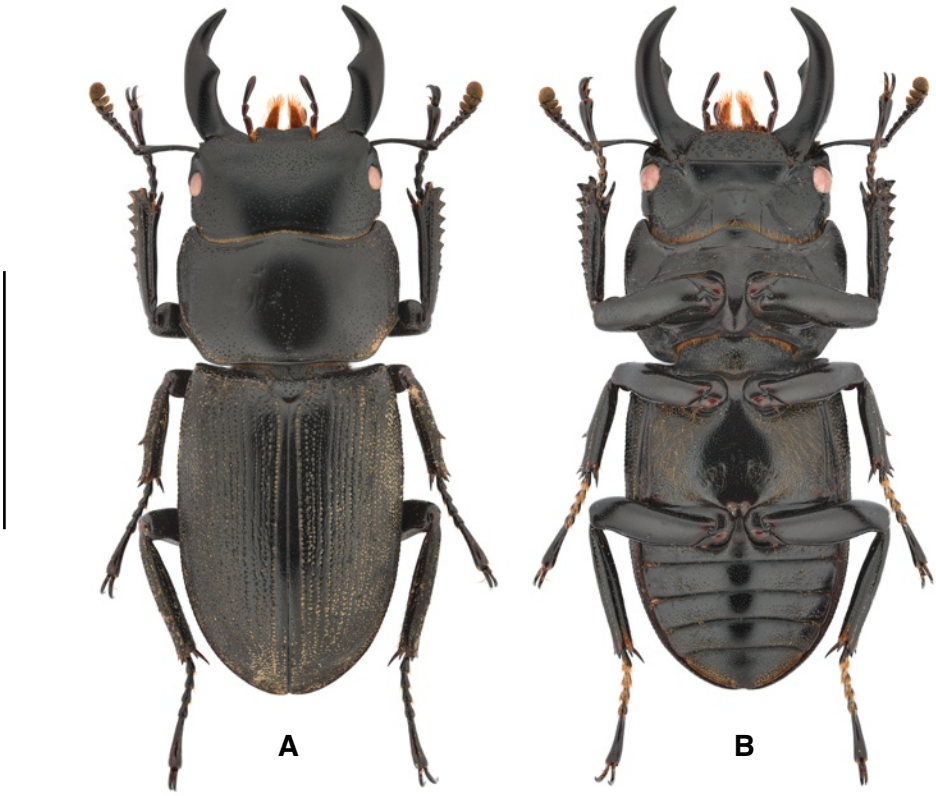

Fig. **3**. Habitus of small sized male of *Dorcus linwenhsini conjunctus* Qi, Bian, Xin & Dang **ssp**. **nov**. (Scale bar = 10.0 mm). **A**, **B**. Paratype, 26.3 mm, Yen Bai, Vietnam. **A**. Dorsal view. **B**. Ventral view.

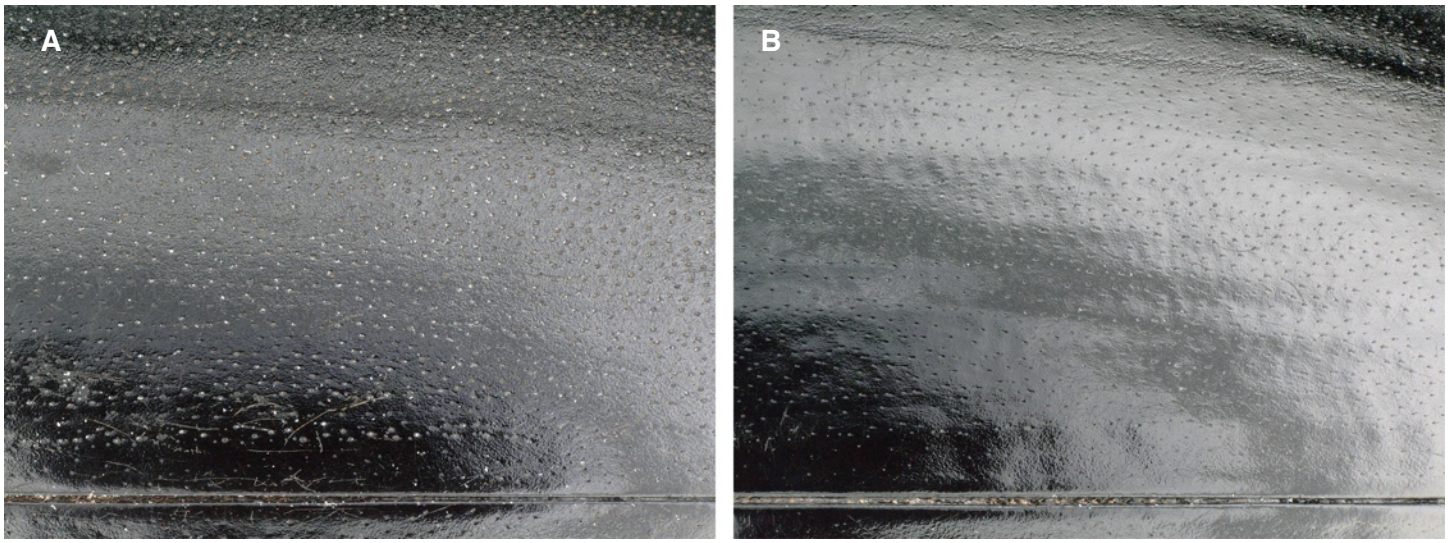

Fig. **4**. The surface of elytra magnified 50× of *Dorcus linwenhsini* ssp. in large sized males.

A. *D. l. conjunctus* Qi, Bian, Xin & Dang **ssp**. **nov**., paratype, 40.6 mm, Yen Bai, Vietnam. **B**. *D. l. linwenhsini* Huang & Chen, 2013, 45.5 mm, Yunnan, China.

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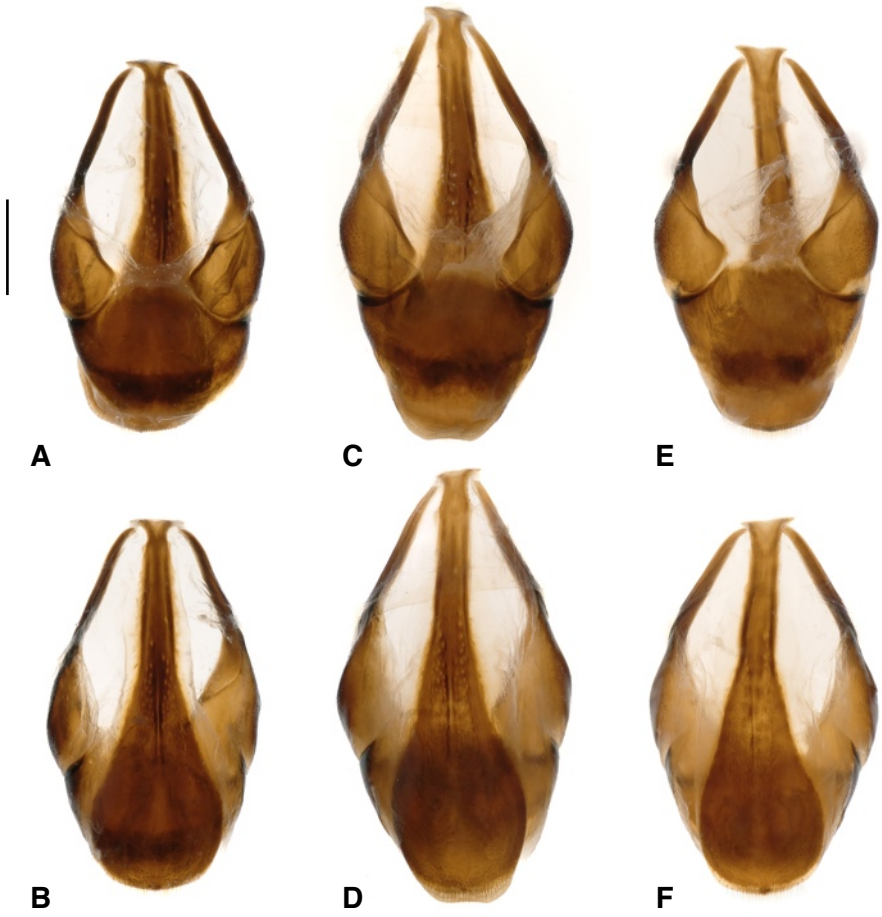

Fig. **5**. Male abdominal segment 9 of *Dorcus linwenhsini* ssp. (Scale bar = 1.0 mm)

A, **B**. *D. l. conjunctus* Qi, Bian, Xin & Dang **ssp**. **nov**., holotype, Yen Bai, Vietnam. **C**, **D**. *D. l. conjunctus* Qi, Bian, Xin & Dang **ssp**. **nov**., paratype, Yen Bai, Vietnam. **E**, **F**. *D. l. linwenhsini* Huang & Chen, 2013, Kachin, Myanmar. **A**, **C**, **E**. Dorsal view. **B**, **D**, **F**. Ventral view.

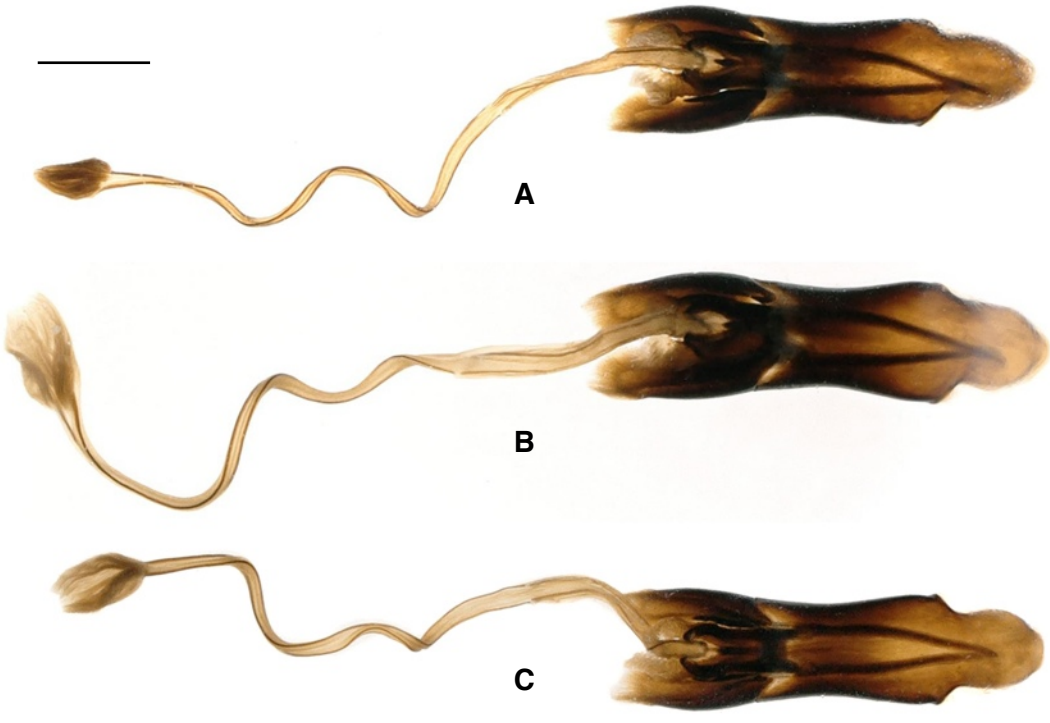

Fig. **6**. Aedeagus of *Dorcus linwenhsini* ssp. in ventral view. (Scale bar = 1.0 mm).

A. *D. l. conjunctus* Qi, Bian, Xin & Dang **ssp**. **nov**., holotype, Yen Bai, Vietnam. **B**. *D. l. conjunctus* Qi, Bian, Xin & Dang **ssp**. **nov**., paratype, Yen Bai, Vietnam. **C**. *D. l. linwenhsini* Huang & Chen, 2013, Kachin, Myanmar.

Fig. **7**. Details of aedeagus (**A-I**) and apex of flagellum (**J-L**) of *Dorcus linwenhsini* ssp. (Scale bar in **A-I** = 1.0 mm; in **J-L**= 0.2 mm). **A-C**, **J**. *D. l. conjunctus* Qi, Bian, Xin & Dang **ssp**. **nov**., holotype, Yen Bai, Vietnam. **D-F**, **K**. *D. l. conjunctus* Qi, Bian, Xin & Dang **ssp**. **nov**., paratype, Yen Bai, Vietnam. **G-I**, **L**. *D. l. linwenhsini* Huang & Chen, 2013, Kachin, Myanmar. **A**, **D**, **G**. ventral view. **B**, **E**, **H**. Lateral view. **C**, **F**, **I**. Dorsal view.

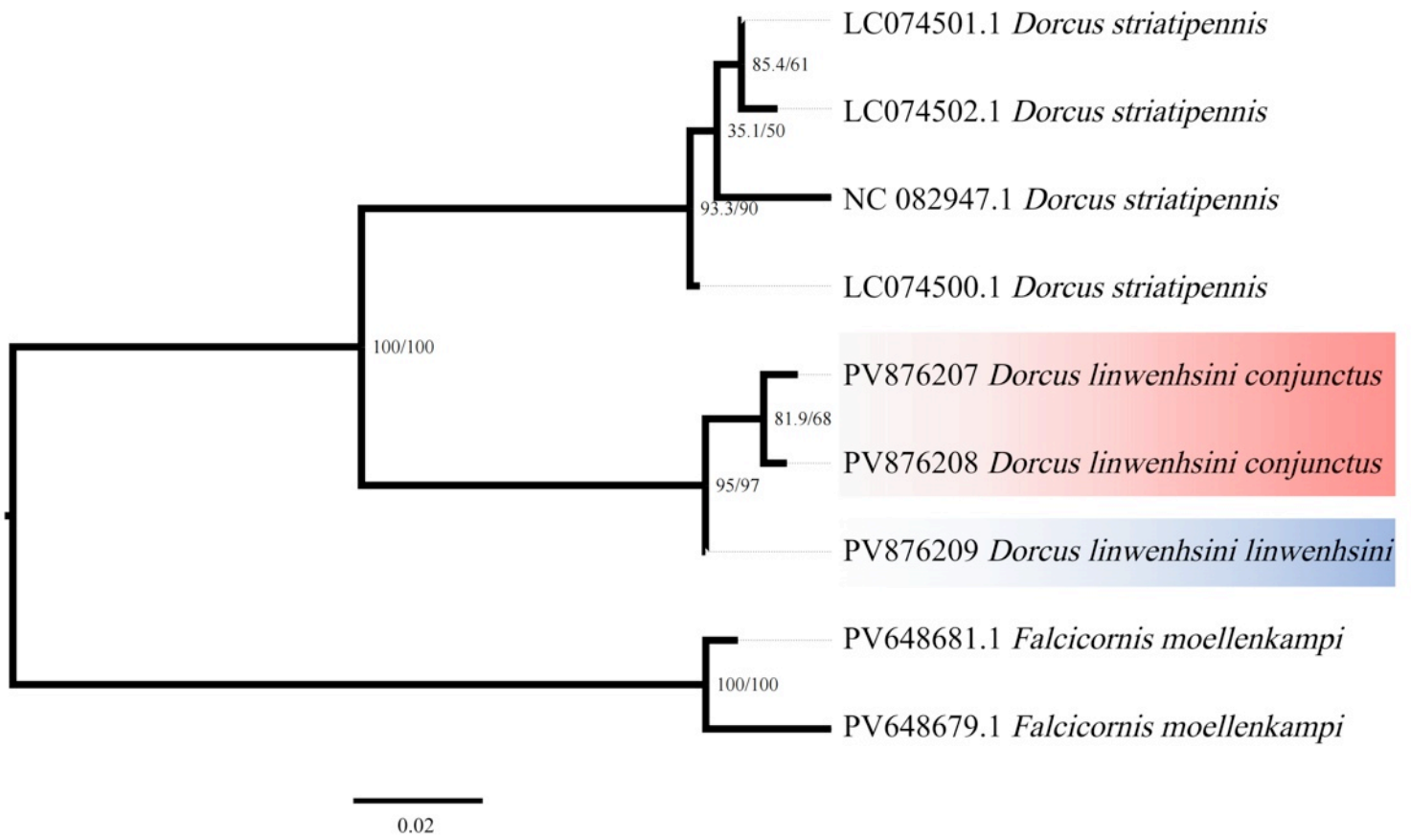

Fig. **8**. Maximum-likelihood phylogenetic tree based on COI fragments between stag beetles of *Dorcus* taxa. SH-aLRT support (%) / ultrafast bootstrap support (%) are labeled near the branch. The red part denote the new subspecies, and the blue part denote the nominotypical subspecie.

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Article proofreading. – ZHQ, FYX, CZB, HTS, GHL
Bibliographic work. – ZHQ, FYX
Material study. – ZHQ, FYX, CZB, VND
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Résumé

Qi Z.-H., Bian C.-Z., Xin F.-Y., Dang V. N., Song H.-T. & Liang G.-H., 2025. – Une nouvelle sous-espèce de *Dorcus linwenhsini* Huang & Chen, 2013 du nord du Vietnam (Coleoptera : Lucanidae : Lucaninae). *Faunitaxys*, 13(52): 1 – 10.

Dans cette étude, une nouvelle sous-espèce de *Dorcus linwenhsini* Huang & Chen, 2013 est décrite et illustrée, à savoir *Dorcus linwenhsini conjunctus* Qi, Bian, Xin & Dang **ssp**. **nov**. des provinces de Yen Bai et de Lai Chau, au nord du Vietnam. La nouvelle sous-espèce se distingue clairement de la sous-espèce nominotypique par la stabilité des dents internes des mandibules. Bien que certains individus du nouveau taxon présentent des variations à l'apex du flagelle de l'édéage, l'analyse des données moléculaires révèle que sa distance génétique par rapport à la sous-espèce nominotypique est de 0,012219-0,013989, ce qui étaye sa classification comme une nouvelle sous-espèce plutôt qu'une espèce indépendante. Une liste des taxons de *Dorcus* du Vietnam est également fournie.

Mots-clés. – Coleoptera, Lucanidae, *Dorcus*, *linwenhsini*, lucane cerf-volant, taxonomie, description, nouvelle sous-espèce, COI, phylogénie, Yen Bai, Lai Chau, Vietnam.

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Faunitaxys

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Illustration de la couverture :

Natural habitat of *Dorcus linwenhsini conjunctus* Qi, Bian, Xin & Dang **ssp**. **nov**. in La Pa Tan, Yen Bai, Vietnam.

Crédits:

Zhi-Hao Qi: Fig. 1-7.
Fei-Yi Xin: Fig. 8.
Van Ngoc Dang: Couverture.

Publié par l'Association Française de Cartographie de la Faune et de la Flore (AFCFF)